

Focus On Mercury

Why Mercury Education

Mercury is a naturally occurring substance that can cause serious health and ecological problems when released to the environment through human activities. Though a national, and even international issue, the mercury problem can easily be studied at the local level. Use this guide to help your students learn about the health and environmental concerns associated with mercury, find out where it is in their school and homes, and help school officials and family members do something about it.

This package contains background materials on mercury for teachers and activities for students. Teachers can do any or all of the activities with their classes or even allow the students to choose the activities they are most interested in. Activities are designed for High School classes, however teachers may consider teaming their students with Middle School classes for some of these activities.

Connection to Wisconsin's Model Academic Standards

Wisconsin teachers should note that these mercury-related activities are applicable to several of the twelfth grade performance standards in "Wisconsin's Model Academic Standards," prepared by the Governor's Council on Model Academic Standards, as shown below.

Science

- G.12.4 Show how a major scientific or technological change has had an impact on work, leisure or the home.
- G.12.5 Choose a specific problem in our society, identify alternative scientific or technological solutions to that problem and argue its merits.

- H.12.1 Using science themes and knowledge, analyze the costs, risks, benefits and consequences of a proposal concerning resource management in the community and determine the potential impact of the proposal on life in the community and the region.

Social Studies

- A.12.6 Collect and analyze geographic information to examine the effects that a geographic or environmental change in one part of the world may have on other parts of the world.
- A.12.11 Describe scientific and technological development in various regions of the world and analyze the ways in which development affects environment and culture.

Mathematics

- A.12.1 Use reason and logic to evaluate information, perceive patterns, identify relationships, formulate questions and ideas that lead to further insight.
- B.12.5 Create and critically evaluate numerical arguments presented in a variety of classroom and real world situations.

What Is Mercury?

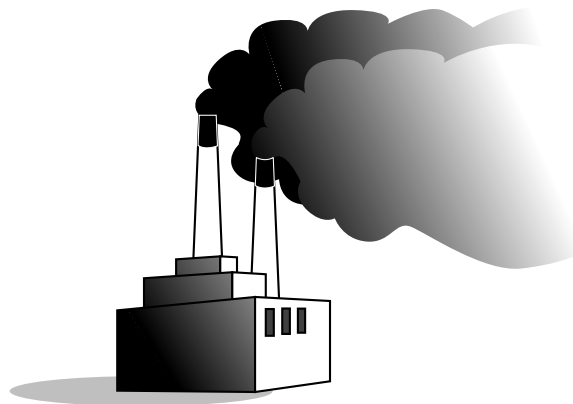
(Excerpted by permission from “Mercury: Get Mad Now, Not Later,” a 1994 factsheet by the Western Lake Superior Sanitary District)

Mercury, also known as quicksilver because it is a silver-colored liquid at room temperature, is an element that does not break down. It occurs naturally and is found in very small amounts in oceans, rocks and soils. It becomes airborne when rocks erode, volcanoes erupt and soil decomposes. It then circulates in the atmosphere and is redistributed throughout the environment. (See page 4 for a listing of the unique and interesting properties of mercury.)

Large amounts of mercury also become airborne when coal, oil or natural gas are burned as fuel or mercury-containing garbage is incinerated. Once in the air, mercury can fall to the ground with rain and snow, landing on soils or water bodies, causing contamination.

Lakes and rivers are also contaminated when there is a direct discharge of mercury-laden industrial waste or municipal sewage. Once present in these water bodies, mercury accumulates in fish and may ultimately reach the dinner table.

Although mercury has been a very useful element, due to its unique properties, it poses a very real health risk—from direct exposure to mercury, as well as from eating contaminated fish. We can minimize this risk by reducing our use of mercury-containing products and properly disposing of mercury-containing waste.



How Is Mercury Released To The Environment from Human Activities?

Mercury has been used for hundreds, if not thousands, of years for a wide variety of purposes. Historical uses, which are no longer prevalent, include: preparing felt for hats, controlling mildew in paints, killing weeds as a component of herbicides, and various medical uses—teething powder, antiseptic ointments and syphilis treatment. It's toxic effects on workers in hat factories in the late 1800's led to the term “mad as a hatter.” Mercury is still used for folk medicine and ceremonial purposes in several cultures.

Today, mercury is released to the environment from many sources. It is used in household and commercial products, as well as industrial processes. Coal-fired power plants, incinerators, some manufacturing plants, hospitals, dental offices, schools and even homes have all been found to release mercury. In the home, mercury can be found in fluorescent lights, thermostats, thermometers, and even some children's toys. At school, mercury may be in science and chemistry classrooms, the nurse's office and electrical systems. School and home mercury audit activities in this package provide more detailed information on where to find it and what to do about it.

Mercury Health Issues

Two different forms of mercury are of human health concern. Elemental mercury, which is most toxic in its vapor form, slowly vaporizes at room temperature and more quickly when heated. Children playing with elemental mercury can be seriously poisoned by breathing the invisible vapor from mercury spilled in carpeting, furniture or other surfaces.

Elemental and inorganic mercury salts can be transformed into organic mercury by the bacteria in the bottom mud in water bodies. Unlike elemental mercury, organic mercury (often referred to as “methylmercury”) can be readily absorbed in humans. The most likely source of methylmercury is eating contaminated fish. Exposure can result in long term damage to the kidney, liver and central nervous system. Young children and developing fetuses are most at risk.

Organic mercury tends to increase up the food chain, particularly in lakes. The mud at the bottom of a lake may have 100 or 1000 times the amount of mercury than is in the water. Worms and insects in the mud extract and concentrate the organic mercury. Small fish that eat these critters further concentrate the mercury in their bodies. This concentration process, known as “bioaccumulation”, continues as larger fish eat smaller fish until the top predator fish in the lake have methylmercury levels in their tissues that are up to 1,000,000 times the methylmercury level in the water in which they live.

Wisconsin advises anglers and their families to reduce their consumption of certain types of fish from over 300 lakes and stretches of river in the state. Thirty-six other states also have issued mercury fish consumption advisories. Certain types of store bought fish also have elevated mercury levels.

Schools, Teachers And Students Can Help

- Choose alternatives to mercury-containing products, such as electronic thermometers and thermostats for home and school.
- Determine if your school recycles its used fluorescent bulbs (which use mercury in the powder inside the glass). If not, help start a bulb recycling program for your school.
- Separate mercury-containing waste and broken or used equipment containing mercury from your trash. Find out if there is a household hazardous waste collection program that will accept these. Are there mercury collection and recycling opportunities available for your school?
- Check the activities presented in this package for other ideas for class or student projects that will help reduce the use or release of mercury in your community.



<i>Special or Unique Properties of Mercury</i>	<i>So What?</i>
● Only metal that is liquid at room temperature.	● Holds fascination for people of all ages. Special ceremonial uses in several different cultures.
● Easily evaporates into the air.	● A blob of mercury sitting on the table will eventually disappear. The mercury vapors can be extremely dangerous to breathe.
● Very dense, yet fluid.	● Just a little bit weighs a lot, yet moves around easily. This is useful in certain medical procedures.
● Good conductor of electricity.	● Used in electrical “tilt” switches and other electrical devices.
● Expands or contracts uniformly with changes in temperature.	● Used in thermometers and thermostats.
● Readily combines (amalgamates) with other metals.	● Dentists combine it with silver to make “amalgam,” which is used to fill cavities in teeth.
● Kills bacteria and fungi.	● Previously used in pesticides, paints and on people to kill germs!
● Certain forms of mercury are easily incorporated into biological tissue.	● Once it gets into your body, it may stay there for a long time.
● Tends to increase in concentration as it moves up the food chain.	● Top predators, including humans, can have thousands of times more in their bodies than worms and insects.

The metal that slipped away

The costs of reining in the ubiquitous spread of mercury are high. The costs of not reining it in may be higher.

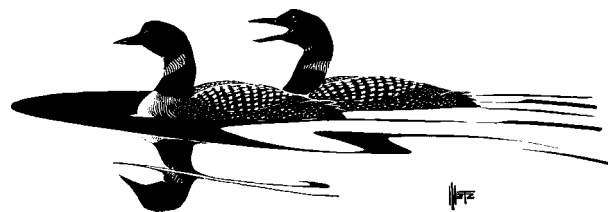
Katherine Esposito

Broken Bow Lake is as charming as they come in northern Wisconsin. Only six miles from the Lac du Flambeau Indian reservation, its 300 acres are surrounded by oaks and pines, in which eagles perch scouting. Its serene, transparent waters are interrupted twice by small wooded islands. And on one of those oases, a female common loon and her mate have prepared a nest each year since 1992.

In the nest, scratched together from lakeweeds, bulrushes, and mud, the same female, known by the color bands circling her legs, laid two eggs every spring.

But chicks have been seen only twice. The first year, 1992, neither egg hatched. In 1993, the pair hatched twin eggs, and one of the nestlings was discovered, lost, clear across the lake. A soft-hearted field technician prevailed on DNR researcher Mike Meyer to reunite the four. The following year, the same thing happened, and this time, nature was allowed to take its course. The chick disappeared. By the time someone later checked on the last one, it, too, was gone.

Since then, three years running, not a single loon chick has survived to migrate from Broken Bow Lake. They may have hatched, but none has ever been seen. What has been found in the female, however, are strikingly high levels of the toxic metal mercury, in a form called methylmercury that can reside in body tissues and blood of animals.



It could be an anomaly, a complete coincidence. There could be a logical explanation for the missing chicks, or it could be a series of mishaps. But the female loon on Broken Bow Lake does fit into a larger, dispiriting picture, one taking place all across North America east of the Rockies: fish in thousands of lakes and reservoirs, and the wild creatures that eat them, are showing up with mercury in their bloodstreams.

Mercury matters because excessive doses are known to damage the human nervous system and cause irreparable harm to the brain. Smaller, chronic, doses can also be trouble, especially for a developing fetus. Severe poisoning episodes in Minamata, Japan in 1956 and Iraq in 1971, in which hundreds of people died and thousands more were permanently injured, form the most shocking examples of mercury's toxic potential. Today, finding mercury in a rustic setting, six hours from Chicago, has scientists scurrying to learn where it is coming from and what damage it is doing to all animals, humans included.

Some scientists support controls now. Minnesota's Edward Swain, a mercury specialist with the Minnesota Pollution Control Agency and principal author of a report documenting increases in Midwestern mercury fallout rates, is among them. "Research is interesting and important, but the basic knowledge is already there. There's too much mercury in the environment," he says. "The big picture isn't that difficult, so the overall decision isn't that difficult."

But Meyer, whose latest research is being published this month, believes that policy decisions should be based on firmer conclusions.

On a sparkly fall day, less than an hour's drive southeast from Broken Bow, the setting sun frames a second study lake. Called Washburn Lake, it also shelters loons, but something here is different: the birds here have raised five generations of chicks to free-flying adulthood. "It's one of our most successful pairs," Meyer says.

The truth, he argues, is that we really don't know if mercury is causing those chicks on Broken Bow Lake to die. Other scenarios are just as likely.

"It could be, every year an eagle comes in to take and eat the young while we're not there," Meyer continues. "I don't think the data for wildlife is sufficient to make a case one way or another. But I think it's plausible it could be having an effect."

Loons as mercury sentinels

Gavia immer, the common loon, a lifelong fish eater and beloved lake resident, seems at particular risk. With its haunting, trembling wail, it steals our attention on warm summer nights, superimposing its songs on those of crickets and cicadas. With its stiletto-sharp beak and its diving and underwater swimming prowess, the loon leads a simple life, needing little but unblemished shorelines and clean water. To the dismay of many, though, we don't seem to be keeping the water as clean as we thought.

Loons are considered sentinel species for mercury contamination in Wisconsin, though high levels have been found in other fish-eating animals, including mink and otter. Now, studies from all over are pointing to certain patterns of mercury pollution.

Mercury concentrations in wildlife slowly decline, it appears, as one traces a line from the wilds of eastern Canada all the way west to Alaska. In Nova Scotia, in Kejimikujik National Park, "frightening" levels of mercury are found in some loons, says Joseph Nocera, a graduate student studying loon behavior and toxicology at Acadia University in Wolfville. The pristine 89,000

acre park, 40 miles from the Atlantic Ocean, is known for its many sphagnum bogs fringed by pines and darkened by natural tannic acid. Here, loons are having more trouble reproducing than anywhere else, Nocera contends.

In New Hampshire and Maine, contaminated lakes and wildlife are also being scrutinized. From there to the Midwest, the amounts found in wildlife gradually lessen, though the element in some Wisconsin birds approaches Nova Scotian levels. Alaskan loon data show only tiny amounts of mercury.

In southern Florida, other fish eaters such as great egrets, great white herons, great blue herons, roseate spoonbills, wood storks, and anhingas all have been found to have mercury in feathers, livers, or eggs. Much larger predators, too, have been affected.

Ironically, more loons than ever are being born in Wisconsin. From 1990 to 1995, their numbers rose from 2,600 to 3,200. But mercury's presence in our waters is a subtle and troubling challenge. If the work of Mike Meyer and others indeed shows that mercury pollution genuinely is causing many wild animals to be less fruitful, it reverts to policy makers to decide if we should do something about it.

Seeking the truth in the environment and wild foods

Meanwhile, we don't know whether humans most at risk — young children and fetuses — are being protected from mercury's harm. In Wisconsin and 39 other states, special advisories are issued to fish eaters, suggesting how to assess risks before eating certain fish from mercury-contaminated lakes. These include identifying the fish species, measuring the fish, and reading the chart. It's easy, but many people aren't that diligent. In other countries, children and mothers dependent on fish may not have the food choices nor the scientific information to avoid possible exposures.

Internationally, the scrutiny of mercury in our environment has reached unprecedented heights. In the Indian Ocean's Seychelle Islands and on the Faroe Islands off the coast of Norway, separate studies of children

born into a fish-eating culture will be reported soon. In the United States, the Environmental Protection Agency's much-anticipated eight-volume, 1,700-page *Mercury Study Report to Congress*, is expected to be completed this winter with several Wisconsin researchers among the reviewers. In the Midwest, the EPA's Great Lakes National Program Office is dedicating considerable effort to a regional mercury reduction strategy.

Many private groups are also looking for answers. The research arm of the utility industry, the Electric Power Research Institute, has been spending millions for studies on mercury in rivers and lakes, and ways to control mercury emissions, if required, from coal burning. Meyer's studies and others have been supported by businesses, agencies, and environmental groups. Those include the Wisconsin Acid Deposition Research Council, the U.S. Fish and Wildlife Service, the North American Loon Fund, and the Sigurd Olson Environmental Institute.

With so many people fingering the pie, one onlooker already expects vigorous debate as these reports begin to circulate. Says Doug Knauer, a DNR research manager, "It's going to be an interesting time, the next 12 months."

How mercury moves

Since the mid-1970s, biologists sampling fish in northern Minnesota and Wisconsin have found mercury in high levels, but they didn't know where it was coming from. It took a decade of inquiry to determine it was coming from the air, especially from distant coal-burning power plants and waste incinerators — not swirled into riverwaters from chemical discharges, not drifted down from an industrial smokestack, because none existed for hundreds of miles. Instead mercury attaches to tiny raindrops that settle after one or two years of floating in the atmosphere.

The scenario is reminiscent of the nation's struggle with acid rain, which also sullies some of our cleanest, most remote lakes. In fact, it was acid rain research that first showed scores of fish tainted by mercury.

Lakes that are more acidic contain bacteria that convert mercury falling from the sky into methylmercury — an organic form that is easily absorbed by the tiniest plants and animals. On its spread through the food web, mercury levels rise in each predator. This process, called bioaccumulation, can result in a level of mercury in the topmost predator up to 10,000,000 times greater than the original amount in surrounding waters.

Beginning around 1990, scientists realized lake acidity wasn't the only important factor at play — it was the bacteria that thrived in those waters. And the same bacteria can live in less acid environments if certain conditions are present. Those include low oxygen levels from decomposing plants and higher sulfides. The best places to find such conditions are in wetlands. So if a lake or river has a wetland feeding water into it, the water will frequently be tainted with methylmercury.

Lakes in Nova Scotia, however, tell their own story. Most have received higher doses of acid rain and mercury than their Midwestern counterparts, swept by prevailing winds from hundreds of industrial sources. Most haven't any limestone to naturally buffer acid water. And when those conditions combine with natural tannins, the mercury levels in fish and wildlife can climb through the roof.

Wisconsin has its own unique scenario. Some lakes are not acidic at all, but receive their water from wetlands, with an abundance of methylating bacteria. Others can blame it on their geologic settings. In the north, almost half of our lakes receive most of their water from the sky, and very little from groundwater because they are perched high above the water table. If the rain and snow are acidic, the lake's chemistry becomes more acid. But five miles away, a lake set lower in the earth which receives more of its water from the ground and less from the air is likely to be less acid.

A pattern emerged, one in three of the 1,000 Wisconsin lakes that have been tested received a mercury warning. Twenty to 30 more lakes are added to the warning list each year. The rest of the state's 15,000 lakes are too small to be fished often, and so they aren't being checked for mercury, according to the DNR officials.

Meyer first showed that Wisconsin loons that made their homes on more acidic lakes carried higher blood mercury levels than those which nested on less acidic lakes. In a subsequent 1992 study, his team examined hatching and survival rates for chicks. Dismal results at Broken Bow Lake, gave them part of their answer. Washburn Lake, where loons raised chicks successfully, is one of the less acidic waters.

Meyer can't say for certain that mercury is directly responsible for the loons' reproductive failure or the chicks deaths. It could be that acidic lakes spawn fewer fish for loons to eat. Clearly, he said, loons accumulate mercury for a while before it affects their reproduction. And it takes a lot less mercury to cause these kinds of problems than it does to poison adult birds.

How much mercury is too much for people?

Severe poisonings in Japan and Iraq show that people can be poisoned and killed by mercury, but we don't know what happens when adults, children and fetuses are exposed to tiny doses over a long time.

Regulators have assumed that people who like fish don't eat too much of any one kind. But in 1994, one Dane County couple and their toddler who ate storebought fish for dinner three to four times a week threw that assumption out the window. After requesting a mercury blood test, each was found to have elevated blood mercury levels but none showed symptoms of poisoning. Seabass imported from Chile, was found to be the cause, according to Lynda Knobeloch, a state health toxicologist. Mercury contained in the seabass was below federal limits, but the entire family ate enough fish to accumulate the toxin in their bodies.

After they ceased eating the fish, the family's mercury levels dropped. That is usually what happens. Small, steady doses of mercury are excreted from the body in about three months. But the case illustrates the scary side of the mercury issue, suggesting that existing laws may be inadequate.

No one knows if other people are receiving regular doses of mercury. In the case of lead, which also can harm the nervous system,

doctors test children fairly routinely and use a certain blood level as evidence of poisoning, says Dr. Henry Anderson, Wisconsin's chief medical environmental officer. No such reference for mercury exists, however. So it's up to physicians to suspect something in a child's behavior or ask about possible exposure.

Lots of people in Wisconsin occasionally eat game fish, but doctors wanted to query those who eat a lot of fish to see if they show any symptoms of mercury poisoning.

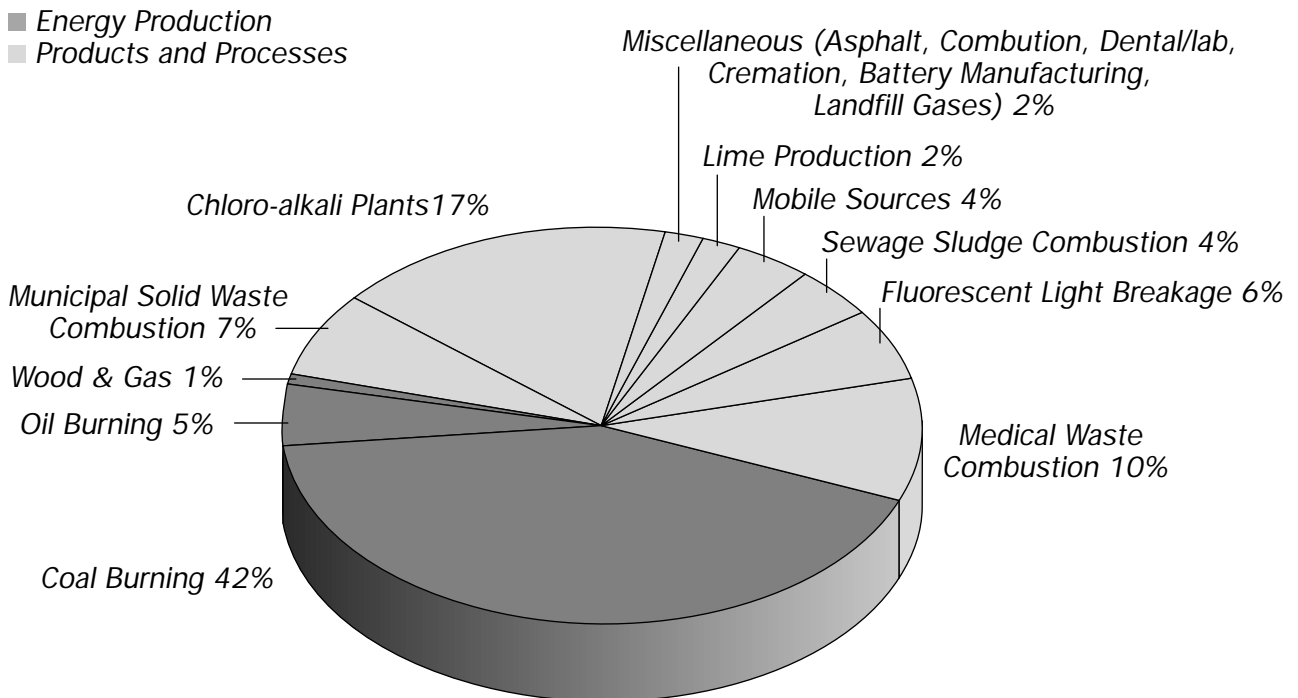
In 1990, a team from Madison surveyed five Chippewa tribes to find whether walleye spearers and their families were being dosed with hazardous amounts of mercury in the fish they ate. The inquiry was spurred, according to Dr. Marty Kanarek, UW-Madison associate professor of preventive medicine, because there had been reports of hand tremors among the Chippewa. Researchers wanted to know whether the known mercury contamination in the walleyes was reflected in Chippewa blood tests, and what kind of threat that posed.

Tests showed those Chippewa eating a lot of walleyes had higher blood levels of mercury, but the levels were far below those that cause overt disease. But excessive alcohol and tobacco use and diabetes are known to cause sickness and trembling, and these conditions were documented among the Chippewa by the same panel in a different study. Whether mercury intake contributed to these factors to produce health consequences is anybody's guess.

Researchers noted that spearfishers seemed to avoid lakes they knew were on the state's mercury advisory, reducing their potential exposure. That underscores the value of the advisories, according to Kanarek. "As long as they [followed] the guidelines, everything was fine."

Limiting human contact with mercury-tainted fish is one way to prevent a possible disaster. But loons can eat up to 1,000 pounds of fish in a season. "Here's a resource at risk," says Doug Knauer. "They don't have any choice. They can't read that they shouldn't be eating fish out of these lakes. They just eat the fish, and eat a lot of it." If they are jeopardized, he wonders, how will we protect them?

Mercury Emissions by Source Type



Reducing mercury emissions

Wisconsin does have a plan. For the next few years, however, it will be entirely voluntary. Last fall, the DNR formed a “stakeholders” study group, to look at ways to control mercury emissions from different segments of society. In charge is Lynda Wiese, director of the DNR’s Bureau of Cooperative Environmental Assistance. Anybody with an interest in the issue can participate, representing those who need and use mercury, find it in their emissions, or are concerned with environmental effects.

In her windowless downtown Madison office, Wiese glances at the bright lights, and shrugs. Gradually, across the nation and in this room as well, incandescent bulbs have been replaced by energy-saving fluorescent tubes, and society has patted itself on its back. Now, we find that the mercury in these lights, about one-tenth the amount in a fever thermometer, is leaking into the air every time a lamp is broken, which commonly happens when they are tossed out. If we decided to return to incandescents, Wiese figures, we’d wind up burning more coal to produce as much light as a fluorescent.

That wouldn’t be wise. Coal-burning power plants already account for more than a third of all Wisconsin mercury emissions. The federal Environmental Protection Agency is now studying toxic materials in utility emissions across the nation. Computers are modeling where mercury from a power plant goes after it leaves the stack, and how much it would cost to collect it. According to an estimate from the Electric Power Research Institute, removing one pound of mercury from a coal smokestack could cost \$40,000. That compares with \$1,000 or less to remove a whole *ton* of nitrogen oxide from a similar stack.

Ironically, no federal limits now exist for mercury in utility emissions, and those covering industry are extremely generous — the limits are set higher than the actual discharges. In fact, Vulcan Materials, in Port Edwards on the Wisconsin River, evaporates 1,100 pounds of mercury every year making caustic soda and other chemicals for paper production. That’s close to half the total from all Wisconsin utilities combined and one-fifth of all Wisconsin mercury emissions. The mercury vapors which leak through doors and windows to the outside air, are legal because years ago, little was known

about the dangers of methylmercury or how mercury can spread. As more has been learned, some sources such as municipal and medical waste incinerators have been required to control mercury in their emissions. And it has been removed as a component of latex paints and fungicides.

After concluding that much of that state's mercury is coming from landfills, Minnesota's Mercury Task Force banned the disposal of certain mercury-containing devices in 1992. Fluorescent lights, thermometers and thermostats, electric switches and more, all known to harbor minute amounts of mercury, must now have it removed before they can legally be thrown away. In 1990, mercury batteries also were banned from landfills, and no longer may be sold in the state.

Minnesota's stakeholder study group has developed incentives to reduce emissions even further. Some suggestions include fees on mercury disposal, emission limits for landfills and utilities, and a "cap & trade" approach, whereby an industry reducing its emissions below a capped level can sell the amount of the reduction to a second industry.

Wisconsin has also banned mercury in most batteries and in children's toys. But for now, most attention will center on ideas like recycling those fluorescent lights and finding substitutes for other small sources of mercury.

Many people are completely unaware that mercury is so ubiquitous, says Alexis Cain, EPA's mercury coordinator. "Emissions from coal burning are a more significant source, but deliberate use [of mercury] is sort of a low hanging fruit," and can be curtailed first, he explains.

Finding substitutes for mercury would be easier if the price of raw mercury reflected its treatment and disposal costs. The metal has been sold from federal stockpiles for as little as \$1 a pound — hardly an incentive to use alternatives.

Meanwhile, scientists recently returned from China are concerned that the mercury drifting in the atmosphere and sprinkling into Wisconsin waters indeed may be

coming from that country and others like it, as they modernize as cheaply and quickly as possible. Unfortunately, cheap and quick can mean older, polluting technologies, such as the kind used by Vulcan, rather than newer, cleaner ones. That presents a quandary — should the Midwest and the nation invest its time and money on an international issue that other countries might choose to ignore?

Perhaps we should start the search closer to home.

There are no industries near the northern Wisconsin lakes where mercury is drifting in, notes Doug Knauer. We speculate it can originate in a distant land and float for years before settling here. Many also wonder if mercury contamination is more regional. Perhaps more of our mercury is coming from Midwestern power plants and incinerators and traveling shorter distances before reaching our lakes.

"You can't take a mercury sample and say where it's coming from," Doug Knauer says. "We have an idea how much is emitted by industry in each state. But we don't know how much falls locally. We're guessing." Where new power plants are sited could be influenced by those answers, as well as which ones should be outfitted with costly emission controls, he adds. The DNR and other groups are seeking money to focus on the Lake Superior basin to track mercury's fate after it leaves a stack. The U.S. Department of Energy, the EPA, EPRI, and several Canadian agencies are interested, too, according to Knauer.

As part of the global community, our responses to such challenges can contain small sources like fluorescent lights, and provide strategies to curtail larger sources like cleaner coal combustion.

"You've got to clean up your house first," Knauer says. "You can't be out there preaching control strategies unless you clean up your own act in your own back yard."

Merc work

One would hope a human mother would be a little suspicious if she came home and found a pink baby doll substituting for her infant.

But loons aren't quite that smart. After Mike Meyer left a plastic Easter egg painted Army green and filled with a tiny balloon of warm water in a nest last summer, the loons didn't notice any difference. Fishers and raccoons tried to make a meal of the egg, and left a pitiful relic behind. But the loons still didn't comprehend.

When the real chick, incubated in a warm lab for two weeks, was returned, nestled and peeping in a wet paper towel, its parents bustled from the water to welcome it into the world. Unfortunately, its stay was not long. A hungry fisher came back, and this time, found something much tastier than a plastic egg.

The only way a scientist could know what truly happened to that single loon egg on a single water — in this case, the Turtle Flambeau Flowage — would be to spend a great deal of time there and imbed radio transmitters in the birds. And that is what Meyer and a colleague, Kevin Kenow, a waterfowl biologist with the US Geological Survey, did. The two men want to figure out exactly why some loon chicks die and some live in northern Wisconsin lakes. Do they die from mercury? Or are there other routine pitfalls in a loon chick's universe?

It can be exhausting work. Each of 14 chicks, hatched in last summer's pilot program had its blood drawn, had a transmitter placed in its chest, and was settled in the nest within six hours of its birth. "We underestimated the amount of effort," Meyer chuckles.

This is the first time that researchers have been able to monitor loon chicks so closely before and after hatching. The radio signals track the birds' movements. If the chick survives to eventually fly off, the transmitters help Meyer to know where it is. Next summer, the goal is to monitor 40 lakes and collect 20 to 25 eggs, he says.

Meyer hopes this work will provide the proof that other studies have lacked. "The bottom line is, to tease out the effects of mercury, Meyer says. "Loon nests fail for lots of reasons. Over one-half of eggs laid in any given year do not hatch - they're eaten by eagles, raccoons, or skunks. Sometimes the nests get flooded. Sometimes they're abandoned if human disturbances are too great."

In addition to the loon studies, the DNR has other programs devoted to addressing mercury issues. Just a few of these include:

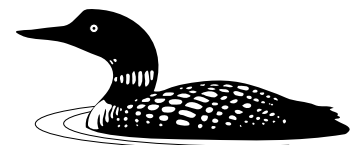
- the Water Division is investigating the idea of a special status for Lake Superior, that would restrict future mercury loadings;
- the Air and Waste Division is evaluating mercury emissions from landfills;
- the Water Division is returning to lakes sampled 15 years ago, to check on mercury levels in walleyes;
- the Enforcement and Science Division is cooperating with other federal agencies to research mercury in rivers and the Florida Everglades;
- the Water Division is developing municipal mercury reduction programs for Milwaukee, Madison, Green Bay and Superior;
- the Cooperative Environmental Assistance program has a business expert promoting mercury pollution prevention among energy producers, hospitals, and dental labs.

Additionally, the DNR has a manual, "The Mercury Sourcebook," containing a wealth of information to help communities reduce mercury use.

For more information on these programs, contact Lynda Wiese, at 608/267-3125.

Katherine Esposito writes about environmental issues from WNR magazine's Madison office.

Wisconsin Natural Resources Magazine February 1998.



Activity 1 - Case Study of Mercury Contamination in a Community

Objective

Review a newspaper report of a mercury contamination incident and information about the effects of mercury in order to evaluate the implications for personal health, community health and the environment.

Materials

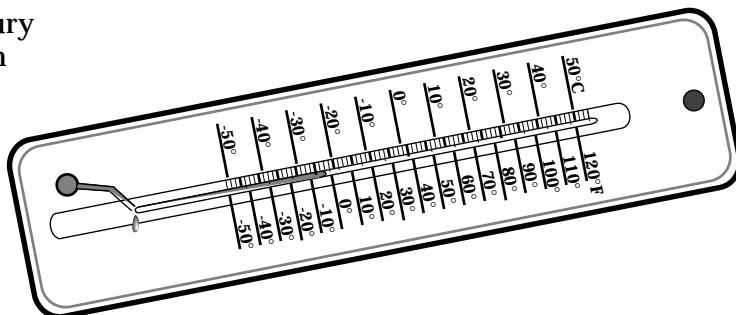
- ✓ Article from the Milwaukee Journal/Sentinel, "Stolen mercury in Arkansas leads to sickness, suspicion, fear"
- ✓ Press release from the Agency for Toxic Substances and Disease Registry (ATSDR), "ATSDR and EPA Warn The Public About Continuing Patterns Of Elemental Mercury Exposure"

Procedure

Assign the above article and press release to be read prior to class. Assign different students to lead the discussion of any or all of the following questions (and/or questions that you develop for this activity). This involves preparing a brief introduction for the topic and facilitating discussion of the question among the other students.

Discussion Questions

- Why should we be concerned about mercury?
- What are some of the symptoms of exposure to mercury?
- Why are young children and fetuses more vulnerable to mercury exposure than adults?
- What are some of the different ways that we can be exposed to mercury?
- How does mercury move around in the environment?



- What would you advise your parents to do if they discovered a broken mercury thermometer in the house? What would you do if you came across a jar of mercury in someone's garbage or in an abandoned lot?
- What dangers are associated with the use of mercury as folk medicine or for religious practices?
- What are some of the special properties of mercury that make it different from other materials?
- Do you think there is mercury in this school? Where?
- Do you think there is mercury in your home? Where?
- Why is it so hard to clean up mercury after it has spilled?

Stolen mercury in Arkansas leads to sickness, suspicion, fear

Some teens stuck their arms in jars of poisonous metal to play with it

By KELLY P. KISSEL
Associated Press

Texarkana, Ark. — A couple of teenagers made the coolest of finds after breaking into an abandoned neon plant last month — a shiny silver liquid that looked neat when it beaded up on their arms.

They just had to share it with their friends.

Now, weeks later, the county is dealing with widespread mercury contamination that has sent two people to the hospital, closed a grocery store and forced seven families from their homes.

"It's very enticing. It looks neat and people think it's harmless and want to play with it, but it can be very nasty," said Donna Garland, a spokeswoman for the Agency for Toxic Substances and Disease Registry in Atlanta.

Since Dec. 30, when one of the teenagers who took part in the break-in was treated for possible mercury poisoning at a hospital, emergency officials have been trying to trace the 2½ pints of the heavy metal that were taken from the city's old neon sign plant. Every few days, more alarmed parents call to say they have a problem.

More than 50 people may have been exposed to dangerous levels of the mercury, which damages the central nervous system and can cause irreversible learning and speech disabilities.

Last week, a vial of mercury carried by a teenager broke inside a combination grocery store and sandwich shop. Emergency workers found out Thursday and closed the store.

"This incident makes us think there is more out there. Every day we turn up more," said Dave Hall, emergency services coordinator in this city of 22,600 people along the Texas line, about 130 miles southwest of Little Rock.

Emergency officials fear that children who once possessed some of the 23 pounds of mercury taken have thrown it out and won't say where. At Garland City, about 15 miles from Texarkana, someone apparently poured some of the mercury out of a moving car just to get rid of it.

"They're scared that they're sick and they're scared of the repercussions from their folks," said Jerry Giles, Miller County emergency director.

Mercury, or quicksilver, has long fascinated people because of its wondrous properties. Some mercury compounds are deadly in minuscule amounts; other forms — such as the regular, elemental variety stolen in Texarkana — are less toxic.

Mercury can cause tremors, insomnia, memory loss, headaches, vision problems, irritability and nervousness. Poisoning is treated by adding other chemicals to the bloodstream that bond with the mercury and remove it from the body as waste.

The owner of the old neon plant, which shut down in the 1970s, told police the break-in occurred before Dec. 16. Garland said the delay in symptoms was typical of gradual mercury exposure; the heavy metal accumulates in the body every time it's handled.

The mercury was in four or five half-pint jars when it was stolen. From there, the youths apparently divided it up among their friends, who put it in all sorts of household jars and other containers.

One person interviewed by police said some of the teenagers would dip their arms in the metal and watch it drip down their arms.

"They played with it extensively, actively," said Texarkana police spokesman Scott Megason.

The theft came to light when one of the boys who took part fell ill. The mother of one of the youngsters also got sick. Megason wouldn't release the boys' names, saying they were suspects in a burglary.

The Environmental Protection Agency has evacuated seven houses, where the vapors had permeated walls, carpets and clothes. The families' possessions were wrapped in plastic and taken to a decontamination center.

Richard Persons said his son, Raymond, and another boy found about two-thirds of a test tube of the mercury.

"As a child, I played with mercury myself," he said. "We played with it at school or we'd bust a thermometer just to play with the mercury inside. But I took it away from him and had him scrub up."

ATSDR and EPA Warn the Public about Continuing Patterns of Elemental Mercury Exposure

Elemental (or metallic) mercury is a hazardous chemical that can cause serious health problems. Children (especially very young children) and fetuses are most vulnerable. The Agency for Toxic Substances and Disease Registry (ATSDR), part of the U.S. Public Health Service, and the Environmental Protection Agency (EPA) are jointly issuing an alert to the general public. There is a continuing pattern of elemental mercury exposure in children and teenagers and in persons using certain folk medicines or participating in certain ethnic or religious practices.

ATSDR and EPA strongly advise against the use of uncontained elemental liquid mercury (that is, mercury not properly enclosed in glass as it is in thermometers) in homes, automobiles, day care centers, schools, offices, and other public buildings.

It is important for the general public to understand that either short-term or long-term exposures to elemental mercury can lead to serious health problems. Human exposure to elemental mercury occurs primarily from breathing contaminated air. Other forms of mercury can be absorbed by drinking contaminated water, eating food (usually fish containing mercury), and from skin contact. At high levels, elemental mercury can effect the nervous system and may harm the developing fetus. Other forms of mercury can damage other organs. Even at low levels, elemental mercury can cause health problems. **Elemental mercury exposure can cause harm before symptoms become evident.** Once released into the environment, mercury is very hard to clean up. If it is left unattended where exposures can occur, it can have dangerous effects on human health.

Incidents involving Schoolchildren

- In recent years, increasing numbers of elemental mercury spills and contamination involving schoolchildren have been reported.
- In August 1994, more than 500 students in Belle Glade, Florida, were contaminated with elemental mercury after three children found 4 jars (totaling 55 pounds) of mercury in an abandoned van. The local hazardous waste materials team decontaminated the children (removed contaminated clothing and washed the elemental mercury from their skin). More than 20 families had to be evacuated while their homes were decontaminated.
- In November 1994, college students at Florida Atlantic University in Boca Raton, Florida, removed elemental mercury from one of the school's laboratories. Students living in the dormitory were evacuated and housed in a local hotel while the dormitory was decontaminated.
- In June 1996, elemental mercury was taken from a middle school in St. Joseph, Missouri, and used in and outside of school by a group of teenagers. Approximately 200 children were tested for mercury exposure; one child was hospitalized and another five underwent outpatient treatment to remove the mercury from their systems; 20 other children had mildly elevated mercury levels. Two homes and a car required extensive decontamination.

- In October 1996, a high school in Oskaloosa, Kansas and a convalescent home in Johnson County, Kansas, were contaminated with elemental mercury; 52 students and an unknown number of residents of the home were tested. On the basis of ATSDR recommendations, the school was closed for a week until indoor air levels were safe. A month later, sampling at the school identified an increase in air mercury concentrations. ATSDR re-evaluated the school and did additional cleanup.
- In November 1996, ATSDR again assisted state health officials and EPA in evaluating contamination at a high school and a home in Dallas, Pennsylvania, near Wilkes-Barre. Four areas in the school had levels of elemental mercury contamination that required cleanup.
- In March 1997, a middle school student on his way to school found elemental mercury on the street in front of his home in Montgomery County, Pennsylvania. The student took the mercury to school and shared it with three to four classmates. Also, in March 1997 a broken mercury thermometer was discovered after school on the floor of a bathroom stall in the boys' bathroom. One thermometer was confirmed missing from the science department's inventory. The school was found to be clear of contamination with the exception of one science laboratory and the carpet in a classroom. Two homes required decontamination.

Schoolteachers, particularly science teachers, and administrators need to be aware of students' interest in mercury, especially elemental mercury, and take steps to ensure that children are aware of its dangers and that any mercury kept in school is safely and securely contained.

Incidents involving religious practices

Persons who use elemental mercury in ethnic folk medicine and for religious practices are at risk. Elemental mercury is sold under the name "azogue" in stores (sometimes called botanicas), which specialize in religious items used in Esperitismo (a spiritual belief system native to Puerto Rico), Santeria (a Cuban-based religion that venerates both African deities and Catholic saints), and voodoo.

The use of azogue in religious practices is recommended in some Hispanic communities by family members, spiritualists, card readers, and santeros. Typically, azogue is carried on one's person in a sealed pouch prepared by a spiritual leader or sprinkled in the home or automobile. Some botanica owners suggest mixing it in bath water or perfume and placing it in devotional candles.

General facts

The following are general facts about elemental mercury and its risks, as well as information about how people can protect themselves from exposure and resulting health effects.

What is mercury and how is it used?

Mercury occurs naturally in the environment in several forms. Elemental mercury is the liquid form used in thermometers. Mercury is also used in other common consumer products such as fluorescent light bulbs, barometers, medical equipment such as blood pressure measurement instruments, and mercury switches in children's sneakers that light up. This alert concentrates on elemental mercury, but hazards are also associated with other types. Of these, the most common is methylmercury contamination of fish.

How could I be exposed to mercury?

In the previously described school-associated cases, children were unaware of the dangers involved in exposing themselves and their families to this deadly poison. Adults are also often unaware of the hazards associated with mercury; some have even brought it home from work for children to play with. Just one-half teaspoon of mercury spilled in the home can be dangerous.

Adults using certain folk medicines or participating in certain religious or ethnic practices may also expose themselves and their families to elemental mercury's effects. Because elemental mercury vaporizes into the air at room temperatures, it presents an immediate health risk to anyone spending a significant amount of time in a room where elemental mercury is sprinkled or spilled onto the floor, or where opened containers of elemental mercury are present. Very small amounts of elemental mercury (for example, a few drops) can raise air concentrations to levels that may be harmful to health.

How does mercury affect health?

At high levels, elemental mercury can cause effects on the nervous system and the developing fetus. Other forms of mercury can damage other organs. Even at low levels, elemental mercury can cause health problems. Mercury exposure can begin to cause harm before symptoms become evident. Once symptoms do arise, health problems related to elemental mercury poisoning can include tremors, changes in vision or hearing, insomnia, weakness, difficulty with memory, headache, irritability, shyness and nervousness, and a health condition called acrodynia. Acrodynia, which results from acute and/or intermediate duration dermal exposures to elemental mercury, is characterized by itching, swelling, and flushing; pink-colored palms and soles of the feet; excessive perspiration; rashes; irritability; fretfulness; sleeplessness; joint pains and weakness. Children exposed to elemental mercury for long periods may have trouble learning in school. Exposure to mercury can result in communication and learning disabilities that may be irreversible.

Pregnant women and their fetuses and women of childbearing age are especially vulnerable to the toxic effects of elemental mercury because it readily passes from the mother to the fetus. Mercury may accumulate in higher concentrations in the unborn baby than in the mother. Young children, who often play on the floor where metallic mercury may have been spilled, are particularly at risk for effects on the central nervous system. Mercury vapors are readily absorbed into the bloodstream from the lungs, and the human central nervous system, which is still developing during the first few years of life, may be damaged.

Health effects can result from short-term or long-term exposure. The body gets rid of mercury through the urine and feces. Removal of this substance from the body can take up to several months after exposure. When mercury levels in the body are extremely high, "chelation" therapy is necessary. Chelation therapy is an unpleasant treatment that involves putting a chemical into the bloodstream; the chemical combines with the mercury to aid in its removal from the body. **Prevention is the key to avoiding poisoning in homes, schools, and families.**

What is mercury contamination and how can I prevent it?

Mercury contamination results from exposure through the air, water, food, soil, or direct contact. Exposure to elemental mercury occurs when it is not stored in a closed container. Contamination may include the spilling of elemental mercury on clothes, furniture, carpet, floors, walls, the natural environment, and even the human body. Elemental mercury and its vapors are extremely difficult to remove from such items as clothes, furniture, carpet, floors, and walls. The vapors will also accumulate in walls and other structures in contaminated rooms. The contamination can remain for months or years, posing a risk to exposed individuals. The use of elemental mercury in a home or apartment not only poses a threat to persons currently residing in that structure, but also to those who subsequently occupy that dwelling and are unaware of the past mercury use.

Avoid using elemental mercury. Appropriate substitutes are available for nearly all uses of elemental mercury. Therefore, be sure you need to use it. If substitutes are not available, make arrangements to safely dispose of whatever elemental mercury you might have by calling your local poison control center. If you do need to use elemental mercury, make sure it is safely stored in a leakproof container. Keep it in a secure space (e.g., a locked closet) so that others cannot easily get it. Use of elemental mercury in a controlled environment helps to reduce the risk that contamination will occur.

Can I clean up mercury with a vacuum cleaner?

Never use a vacuum cleaner. Using a vacuum cleaner causes elemental mercury to vaporize in the air, creating greater health risks. It also ruins the vacuum cleaner.

Can electronic equipment collect mercury vapors?

Elemental mercury vapors can accumulate in electronic equipment, especially computers. When the computer is turned on, the mercury reevaporizes. This cycle of elemental mercury collecting and vaporizing from computers has been seen in several incidents in schools.

Mercury vapors are very dangerous and are virtually undetectable. Avoid breathing mercury dust, vapor, mist, or gas. Avoid contact with eyes, skin, and clothing. If you feel you have been exposed directly to elemental mercury, wash thoroughly after handling. Remove contaminated clothing and wash before reuse. If someone has breathed in mercury, provide as much clean air as possible.

What should I do to keep my home safe?

Care must be taken in handling and disposing of all items in the home that contain elemental mercury. Elemental mercury is used in a variety of household and industrial items including thermostats, fluorescent light bulbs, barometers, glass thermometers, and some blood pressure machines.

Example

If a thermometer breaks, remove children from the area. Clean up the bead of elemental mercury by carefully rolling it onto a sheet of paper or sucking it up with an eye dropper. After picking up the mercury, put it into a jar or airtight container. **Do not wash it down the drain or throw it outside.** The paper or eye dropper should also be bagged and disposed of properly according to guidance provided by environmental officials or your local health department. Try to ventilate the room to the outside and close off from the rest of the home. Use fans for a minimum of one hour to speed the ventilation. If larger amounts of elemental mercury are found (for example, a jar), make sure that the mercury is in an airtight container and call your local health department for instructions in how to safely dispose of it. If a larger amount is spilled, leave the area and contact your local health department and fire authorities. Do not simply throw it away, but instead seek professional guidance from environmental officials or your local health department.



Important Telephone Numbers

- Agency for Toxic Substances and Disease Registry (ATSDR) Emergency Response
- Hotline (24 hours): (404) 639-0615
- National Response Center
1-800-424-8802
- Superfund Information Hotline:
1-800-424-9346
- You may also call your local health department



Activity 2 - A Local Survey About Mercury

Objectives:

Students will: 1) design and conduct a survey of their community on the subject of mercury; 2) evaluate the results of the survey and design an action plan to address the survey findings.

Materials:

Sample Survey

Background:

Are residents in your community concerned about mercury? Do any businesses use mercury in their operations? Does your community have the cleanup equipment to handle a mercury spill? Do residents in your community know about the dangers of mercury? Are any lakes in your region listed in the state fish advisory? Do anglers care?

One method of finding answers to these questions and others is to design a survey and conduct it in your community. It is an interactive process that requires preparation, involvement and interpretation. The results can lead students to take an active role in solving or reducing an environmental problem in their community.

Several different methods can be used to study environmental issues. Here are 2 different methods.

Surveys. A survey can be used to collect information about environmental conditions in your school and community. It focuses on information about a specific problem in a certain area.

Example: How many mercury thermometers do you have in your home?

Opinionnaires. Opinionnaires measure the beliefs or opinions of people on certain subjects at a specific time.

They are that person's opinion - which may or may not be accurate or correct. For example:

I believe mercury is dangerous to human health.

Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree

Before a method is selected, it is important that students carefully decide the exact information that needs to be collected, the geographic area they want to cover, and the target population that will be surveyed. A combination of methods can also be used. Accurate collection of the information is next. The students should prepare a data summary sheet to record their information.

Once the data has been collected, students will be challenged to interpret the information and suggest ways to share their results and actions that need to be taken.

A valuable book to assist you in developing and utilizing surveys is, "Investigating and Evaluating Environmental Issues and Actions: Skill Development Modules", by Harold Hungerford and others. Stipes Publishing Company, 10-12 Chester Street, Champaign, IL 61820

Procedure:

1. Have the students use the sample survey or design a new one to conduct a community survey on the topic of mercury. Students are encouraged to add new questions especially targeted at their community.
2. Students will identify a target audience and conduct the survey. Target audiences could include: homeowners, adults, students, teachers.
3. Tabulate and analyze the results of the survey and prepare a report. Students should then identify various action steps they could take to increase the knowledge of the given audience on the subject of mercury.

Model Mercury Survey

Hello, my name is _____. I am a student at Mercury High School. I am doing research on mercury in our community. I would like to ask you several questions about this topic. The survey will take about 10 minutes.

Person Responding: Male ____ Female ____

Age: <20 ____ 20-40 ____ 40-60 ____ 60+ ____

Yes ____ No ____ 1. Do you consider mercury dangerous to human health?

Yes ____ No ____ 2. In the last year, have you heard or read of any local or national news story that describes an incident involving mercury?

Yes ____ No ____ 3. Do you fish?

Yes ____ No ____ If yes, have you read the fish advisory booklet that describes the warnings for eating fish from certain bodies of water in Wisconsin?

Yes ____ No ____ 4. Do you know that the sale of children's toys containing mercury have been banned in Wisconsin?

For each of the following statements, tell me whether you strongly agree, agree, neutral, disagree, or strongly disagree.

4. All thermometers contain mercury.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5. Mercury should be stored in locked cabinets at school.

Strongly Agree Agree Neutral Disagree Strongly Disagree

6. Switches and thermostats that contain mercury should be clearly labeled.

Strongly Agree Agree Neutral Disagree Strongly Disagree

Please rate on a scale of 1 (not important) to 5 (very important) the following statements:

7. Mercury should be banned from use in children's toys.

1 2 3 4 5

8. Non-essential uses of mercury should be phased out in our community.

1 2 3 4 5

9. Firefighters and emergency personnel should be trained to handle a mercury spill.

1 2 3 4 5

Please answer True or False to the following:

T ____ F ____ 10. Mercury spills in schools have resulted in evacuations and expensive cleanups.

T ____ F ____ 11. Several different cultures use mercury for ceremonial or religious purposes.

T ____ F ____ 12. Once mercury gets into your body, it may stay there for a long time.

T ____ F ____ 13. The burning of fossil fuels like coal release mercury into the air.

Please answer the following questions:

14. What would you do if you found a jar of mercury in your basement?

15. Do you read and follow the advice given in the Wisconsin Fish Consumption Advisory?
Why or Why not?

16. What are the symptoms of mercury poisoning?

17. Circle the household items that may contain mercury.

thermometers

kid's maze games

mercurochrome

hair shampoo

switches in laundry equipment

sphygmomanometers

most plastics

some nasal sprays

Thank you.



Activity 3 - School Mercury Audit

Objectives

- Involve students in a meaningful, real-life opportunity to do something about an environmental problem at their school.
- Reduce or eliminate opportunities for students and staff to come in contact with mercury.
- Prevent the release of mercury into the environment from mercury or mercury-containing devices at school.

Materials

- ✓ “Mercury At School: Where To Look And What To Look For”, a guide for conducting a school mercury audit.

Procedure

- Obtain approval from your principal.
- Discuss the audit with your school’s engineering and/or janitorial staff.
- Introduce the topic of mercury to the class, using any or all of the materials included in the *Focus on Mercury* section of this package. Consider doing some of the other mercury related activities first. In particular, the *Case Study of Mercury Contamination in a Community*, provides a good introduction to the topic.
- Hand out copies of “Mercury at School: Where To Look And What To Look For” to students and ask them to review it ahead of time.
- Have the students develop an audit “plan,” i.e. where will they go, what will they look for, who will they talk to, and what will they ask?
- Conduct the audit using the mercury audit form or a form designed by the students.
- Have students discuss the results with engineering and/or janitorial staff. Make recommendations for safely recycling mercury and replacing mercury-containing products or equipment, as appropriate.



Mercury at School

Where to Look and What to Look For

Science And Chemistry Class Rooms

Check for: pure mercury, mercury compounds, thermometers

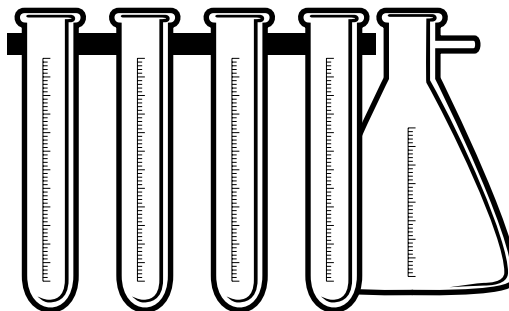
Why?: Mercury and mercury compounds were used in various experiments. They may or may not be used now, but they may still be in the cabinet or closet. Mercury thermometers may be used in science, chemistry, biology and physics classes.

Alternatives: Other chemicals can be used in class experiments to illustrate science or chemistry principles. Alcohol or electronic thermometers are readily available and sufficiently accurate.

Who to Talk to: Chemistry and other science teachers

Questions to Ask:

- (1) Are mercury or mercury compounds currently used in class?
- (2) If they are being used, could other chemicals replace them?
- (3) Do you know if these have been used in the past in science classes in this school?
- (4) Are these being stored in a closet, cabinet or elsewhere?
- (5) How many mercury thermometers are in the class room?
Have you ever experienced a spill of mercury or a broken thermometer in your class room?
- (7) Is a spill kit readily available, if a spill occurs?
- (8) Are you familiar with the proper spill control procedures for mercury?



Possible Actions: Make sure any mercury, mercury compounds or thermometers are in non-breakable containers. These should all be collected by school engineering and/or janitorial staff, held in a safe, secured area prior to recycling them.

Your school should not wait for mercury thermometers to break before replacing them with non-mercury alternatives. If mercury thermometers will not be replaced at this time, obtain spill kits for the science class rooms and storage rooms. Make sure that at least several staff people are trained in proper spill control procedures.



Mercury at School

Where to Look and What to Look For

Nurse's Office

Check for: thermometers, blood pressure measuring device (sphygmomanometer), nasal spray and contact lens solution

Why?: Mercury thermometers are used to check for fever.

Sphygmomanometers can contain up to several pounds of mercury.

Nasal spray and contact lens solution may contain thimerosal (an ingredient that has mercury in it), phenylmercuric acetate or phenylmercuric nitrate.

Alternatives: Alcohol or electronic thermometers are readily available.

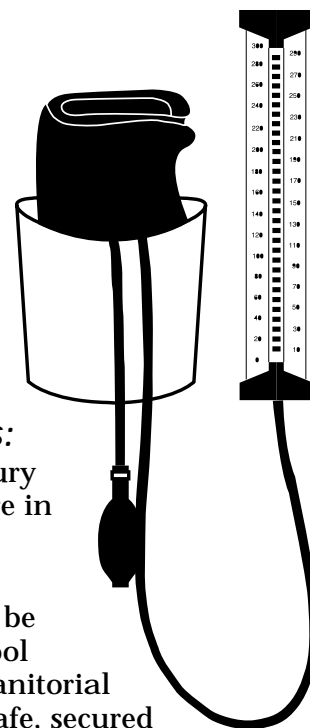
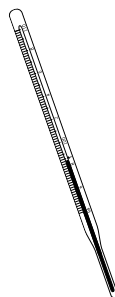
Aneroid blood pressure devices are just as effective as the mercury versions.

Many brands of nasal spray and contact lens solution do not contain mercury.

Who to Talk to: School Nurse

Questions to Ask:

- (1) How many mercury thermometers are in the nurse's office?
- (2) Have you ever experienced a broken thermometer?
- (3) Is a spill kit readily available, if a spill occurs?
- (4) Are you familiar with the proper spill control procedures for mercury?
- (5) Do you use a sphygmomanometer? If yes, have you considered replacing it with an aneroid blood pressure device that does not contain mercury?
- (6) Do you stock nasal spray or contact lens solution? If yes, have you checked the list of ingredients or contacted the manufacturer to make sure they do not contain mercury?



Possible Actions:

Make sure mercury thermometers are in non-breakable containers.

These should all be collected by school engineering or janitorial staff, held in a safe, secured area prior to recycling them.

Do not wait for mercury thermometers to break before replacing them with alcohol or electronic alternatives.

Replace sphygmomanometers with aneroid blood pressure devices.

If mercury thermometers or sphygmomanometers will not be replaced at this time, obtain a spill kit for the nurse's office. Make sure that the nurse(s) are trained in proper spill control procedures.

Use up existing stock of nasal spray or contact lens solution containing mercury and then purchase mercury-free alternatives.



Mercury at School

Where to Look and What to Look For

Electrical And Heating Equipment

Check for: thermostats, “silent” light switches and recycling of fluorescent light bulbs

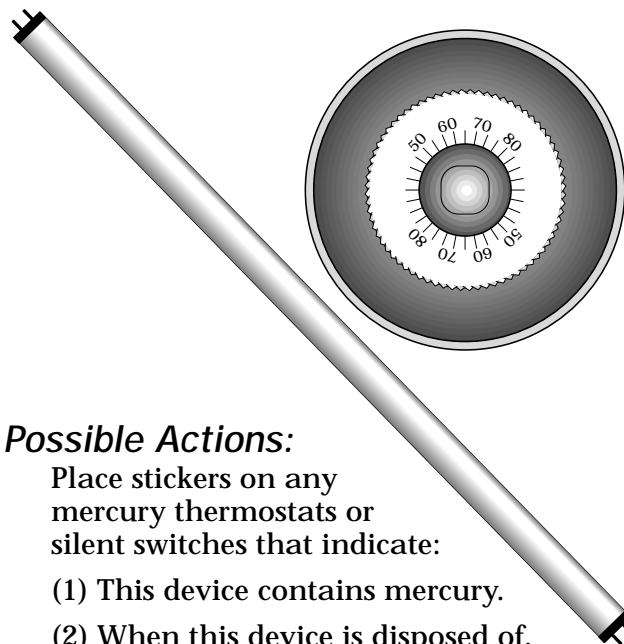
Why?: Thermostats are used to control the temperature in buildings. Approximately 80% of thermostats in use today contain mercury. Many “silent” light switches contain mercury. Each fluorescent tube in overhead lighting fixtures contains a minute amount of mercury. However, your school probably uses a large number of these fluorescent bulbs throughout the building, so the total amount of mercury can be significant.

Alternatives: Electronic thermostats and non-mercury switches are widely available. Fluorescent bulbs should be recycled, rather than thrown out.

Who to Talk to: School engineering or janitorial staff

Questions to Ask:

- (1) How many thermostats and “silent” light switches are there in your school building?
- (2) How many of these contain mercury?
- (3) How are used fluorescent bulbs managed? Are they recycled or thrown out in the trash?
- (4) If they are recycled, how and where are they stored before they are taken from the building for recycling?



Possible Actions:

Place stickers on any mercury thermostats or silent switches that indicate:

- (1) This device contains mercury.
- (2) When this device is disposed of, the mercury should be recycled.
- (3) When purchasing a replacement, a mercury-free model should be chosen.

Honeywell Corp. has a free take-back program for used mercury thermostats. Call 1-800-345-6770 for more information.

Notify the purchasing department to try to get mercury-free thermostats or light switches when purchasing replacements.

Your school should recycle used fluorescent bulbs by replacing them in their original box in a safe, secure storage area until they are picked up by a recycling contractor.

Fluorescent & High-Intensity Discharge (HID) Lamps

Which Lamps Contain Mercury?

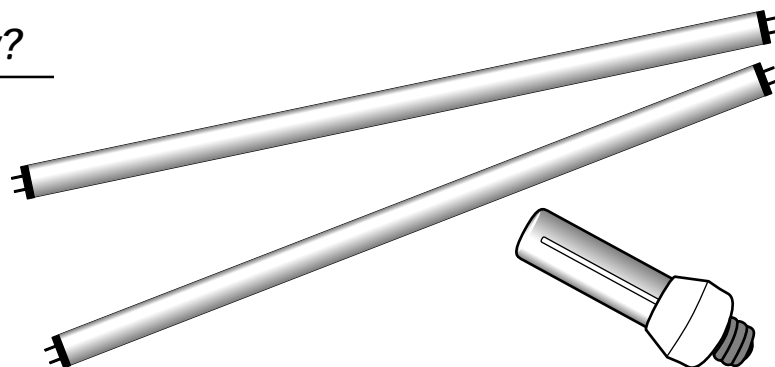
- fluorescent lamps
- mercury vapor lamps
- metal halide lamps
- high pressure sodium lamps
- neon lamps

Why Use Fluorescent and HID Lighting?

Fluorescent and HID lighting is an excellent business and environmental choice because it can use up to 50 percent less electricity than incandescent lighting. However, used fluorescent and HID lamps must be managed properly because they contain mercury.

How Do I Dispose of the Lamps?

- Store lamps in an area and in a way that will prevent them from breaking, such as in boxes the lamps came in or boxes supplied by lamp recyclers.
- Mark the lamp storage area with the words "Fluorescent lamps for recycling."
- Do not break or crush lamps because mercury may be released.
- If lamps are accidentally broken, store them in a sealed container. Pick up spilled powder and add it to the sealed container.



- Take lamps to a consolidation site* or arrange with a lamp transporter to pick them up. Contact your county or state environmental office or solid waste office for services available in your area. To protect yourself from future liability, save the invoices that track your lamps and include the following information:

- the date of shipment
- the number of lamps
- the location from where the lamps are being shipped
- the destination of the shipment

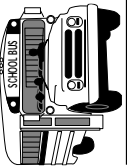
**These services may not be available in your area.*



MINNESOTA POLLUTION CONTROL AGENCY
1-800-657-3864 TDD: 612-282-5332

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
1-800-662-9278

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
1-608-267-9388



Mercury At School

Date _____ Class _____

Item	Location	Recommended Action	Who's Responsible
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Item Location Recommended Action Who's Responsible



Activity 4 - Hunt For Mercury At Home

Objectives

- Involve students in a meaningful, real-life opportunity to do something about an environmental problem at home.
- Reduce or eliminate opportunities for students and their families to come in contact with mercury.
- Prevent the release of mercury into the environment from mercury or mercury-containing devices at home.

Materials

- ✓ “Hunt for Mercury at Home,” a guide for conducting a home mercury audit.

Procedure

- Introduce the topic of mercury to the class, using any or all of the materials included in the *Focus on Mercury* section of this package. Consider doing some of the other mercury related activities first. In particular, the *Case Study of Mercury Contamination in a Community*, provides a good introduction to the topic.
- Try to find out the local contacts for household hazardous waste collection and mercury thermostat recycling and add these to the bottom of the third page of “Hunt for Mercury at Home.” The sewage treatment plant or Dept. of Public Works are good places to find out if there is a household hazardous waste collection program in your area. Call 1-800-345-6770 to determine how to recycle used mercury thermostats in your area.
- Hand out copies of “Hunt for Mercury at Home” to students and allow them 3-7 days to complete the exercise.
- Make sure that students understand that they need to discuss this activity with their families before they do it and that it works best if they get help from family members.
- Have students compare their results and discuss safe ways of addressing the mercury in their homes.



Hunt For Mercury At Home

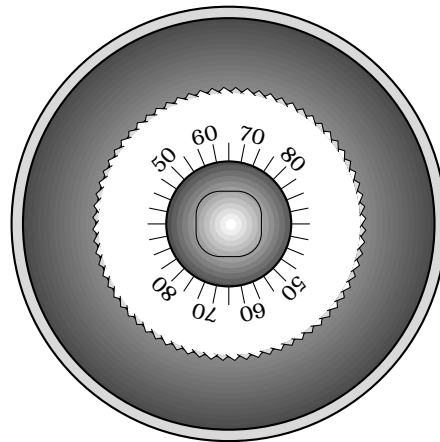
A Guide and Checklist to Help You Inventory the Mercury in Your Home, Learn about Safe Disposal Options and Mercury-Free Products

This guide provides a list of what to look for, what to do about mercury-containing products if you find them and what mercury-free substitutes are available.

Before getting started, share information about mercury with your family and let them know why you are searching for it in your home. Other family members may be able to help you identify products that contain mercury and help you decide what to do about them.

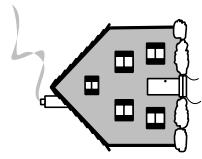
Remember, the primary concern about many of these mercury-containing products is when you dispose of them, and not necessarily contact with them in your home. You do not need to throw out all the mercury-containing products that you find.

A good example is thermostats. Many of you will find thermostats with mercury in your homes. These are designed to last a long time and are not a hazard to you and your family unless they break and spill the mercury. In this case, the best approach is to let your parents know that different types of thermostats are available and, if they replace the one they have now, they should install a mercury-free thermostat and properly recycle the old one.



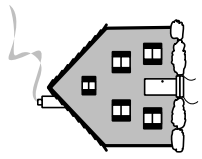
This guide provides advice for what to do about each of the mercury-containing products that you may find in your home. Make sure to consider common sense, recycling, safety and pollution prevention before taking action.

You can also use this guide to help you and your family buy products that do not contain mercury. In the future, you won't have to worry about mercury in the home if you are careful about not buying mercury-containing thermometers, toys, sneakers or thermostats, for example. Buying smart is a great way to prevent pollution!



Hunt For Mercury At Home

Product	Description	What To Do	Mercury-Free Alternative
Thermometers	Silver liquid in tube	Bring to Household Hazardous Waste Facility	Alcohol or digital thermometer
Thermostats	All non-electronic models	When it needs replacing, recycle — call the national thermostat recycling program	Electronic "set back" models can help save on energy bills
Fluorescent lights	Light bulbs in the form of long or curved tubes	Continue to use these, however, recycle them at the Household Hazardous Waste Facility	None, although some newer bulbs have less mercury than others
Old Alkaline Batteries	Bought before 1990	Bring to Household Hazardous Waste Facility	Rechargeable batteries
Mercurochrome	An old time antiseptic for cuts and scrapes	Bring to Household Hazardous Waste Facility	New antiseptics do not contain mercury.
Maze Toys	Contain blob of mercury	Bring to Household Hazardous Waste Facility	Mercury-free games
Old toys that Light Up or Make Noise	May contain mercury button batteries.	Bring to Household Hazardous Waste Facility	Toys that <u>don't</u> light up or make noise
Shoes that Light Up When You Step	Bought before June, 1994	Bring to Household Hazardous Waste Facility	Sneakers that don't light up



Hunt For Mercury At Home

<i>Product</i>	<i>Description</i>	<i>What To Do</i>	<i>Mercury-Free Alternative</i>
Chemistry Sets	May contain mercury compounds	Bring mercury to Household Hazardous Waste Facility, or mercury compounds	Other mercury-free toys
Contact Lens Solution	May contain Thimerosal or other mercury compounds	Check the label, then use it up	Other brands that don't contain any mercury compounds
Vials of Mercury	Small containers of mercury used for ceremonial purposes	Bring to Household Hazardous Waste Facility	None

Nearest Household Hazardous Waste Collection Facility:

Person To Call To Find Out About Household Hazardous Waste Collection In Your Community:

Telephone Number To Call About National Thermostat Recycling:



Household Mercury

(from "Mercury Source Sector Assessment for the Greater Milwaukee Area, " by the Pollution Prevention Partnership and the Milwaukee Metropolitan Sewerage District)

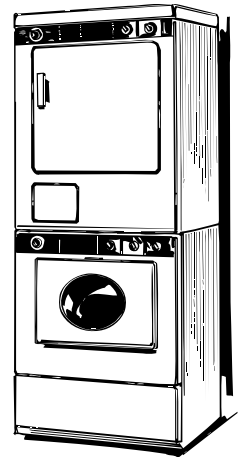
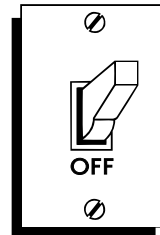
The household sector was included in this study to illustrate how the average residential household contributes to the use and release of mercury to the environment. The household sector includes thermostats, switches, gasoline combustion and others which were also evaluated in other source sector estimates. The idea is to provide a sense of how our daily activities, as well as devices and products in our homes, contribute to the overall picture of mercury release and use.

Tables are provided for both releases and presence/use of mercury in households. "Releases" are defined very broadly and include air emissions, discharges to streams, lakes or sewers, and placement in landfills. The following types of releases from households are included in the estimate of mercury releases from households:

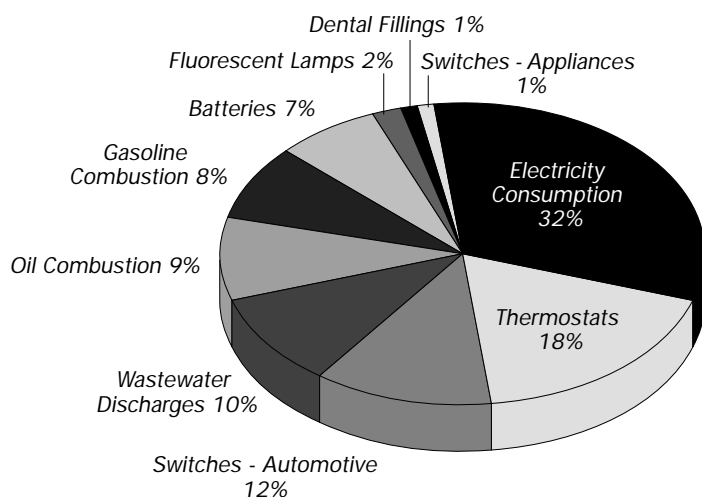
- batteries
- coal combustion to produce electricity
- fluorescent lamps
- gasoline combustion in motor vehicles
- heating oil combustion
- appliance switches
- automotive switches
- thermostats
- volatilization from dental fillings
- wastewater discharged to sewers

The following occurrences or uses of mercury are included in the estimate of presence/use of mercury in households:

- automobile switches
- batteries
- chest freezers
- dental fillings
- fluorescent lamps
- gas-pilot ranges
- light switches
- thermometers
- thermostats
- washing machines



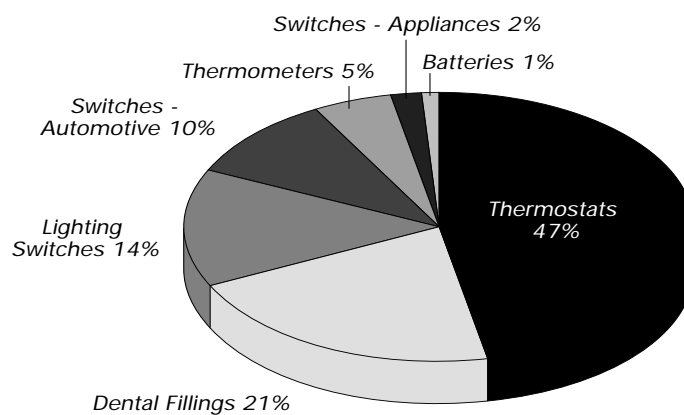
Annual Mercury Releases from Households



Sector	Amount (lb per yr)	Percent of total
Electricity Consumption ..	122	32%
Thermostats	70	18%
Switches - Automotive	45	12%
Wastewater Discharges	40	10%
Oil Combustion	33	9%
Gasoline Combustion	30	8%
Batteries	28	7%
Fluorescent Lamps	7	2%
Dental Fillings	4	1%
Switches - Appliances	4	1%
Total Household Releases	383	100%

Sector	Amount (pounds)	Percent of total
Thermostats	2095	47%
Dental Fillings	942	21%
Lighting Switches	631	14%
Switches - Automotive	446	10%
Thermometers	210	5%
Switches - Appliances	109	2%
Batteries	28	1%
Fluorescent Lamps	21	<1%
Total Presence/Use	4483	100%

Presence/Use of Mercury in Households



From "Mercury Source Sector Assessment for the Greater Milwaukee Area" by the Pollution Prevention Partnership and Milwaukee Metropolitan Sewerage District. 1997

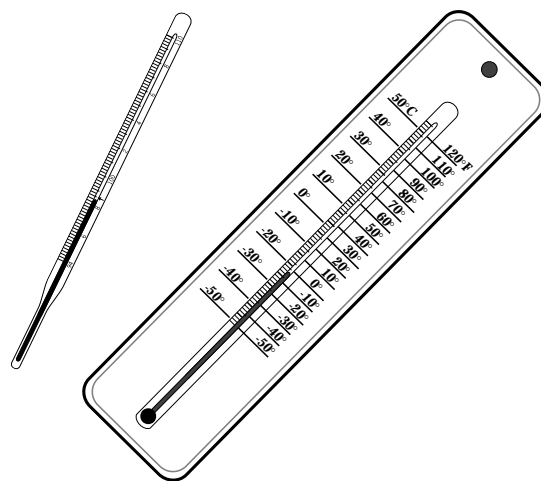
Mercury Thermometers

Some fever and laboratory thermometers contain mercury and should not be thrown in the trash. A typical fever thermometer contains about 0.5 grams of mercury. Larger laboratory thermometers can contain up to 3 grams of mercury.

Many thermometers used to measure air and water temperature also contain mercury, and they are used by homeowners, businesses, institutions, and recreational anglers. When these thermometers break outdoors, the mercury from them is difficult to capture.

Spirit-filled or digital thermometers are as accurate as mercury thermometers for most applications. Since they are mercury-free, no mercury will be released if they break in the home, laboratory or outdoors, or when they are thrown away. Digital thermometers last longer because they do not break. Consequently, they cost less in the long run.

Change to spirit-filled or digital thermometers whenever feasible. In the meantime, save old or broken mercury thermometers in a closed container. If a thermometer breaks, pick up all the mercury you can and add it to the container. Use two pieces of paper or two razor blades to scoop it up from a smooth surface. Use an eyedropper to pick up pieces of mercury from the floor or the ground. Mercury spill kits are available from safety equipment supply companies for large mercury spills.



How Do I Dispose Of Mercury Thermometers?

Homeowners can use local household hazardous waste collection programs* for broken thermometers. Businesses should deliver discarded thermometers to a consolidation site* or arrange with a transporter to take them. Contact your county or state environmental office or solid waste office for services available in your area.

**These services may not be available in your area.*



MINNESOTA POLLUTION CONTROL AGENCY
1-800-657-3864 TDD: 612-282-5332

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
1-800-662-9278

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
1-608-267-9700

Mercury-Containing Thermostats

Mercury-containing tilt switches have been used in thermostats for more than 40 years. They provide accurate and reliable temperature control, require little or no maintenance, and do not require a power source. However, each switch contains approximately 3 grams of mercury.

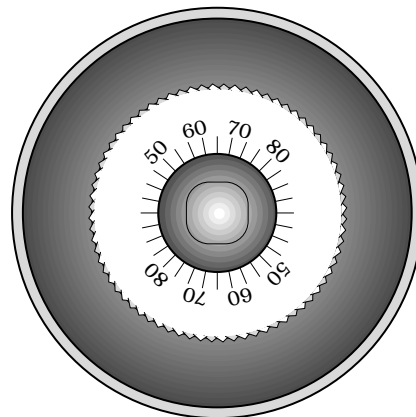
Mercury-free thermostats are available. Electronic thermostats for example, provide many of the same features as mercury thermostats. Both types can be programmed to lower room temperatures at pre-set times. This results in fuel cost savings and the environmental benefits from burning less fuel.

How do I Dispose of Mercury-containing Thermostats?

Honeywell Corporation has a free take-back program to collect used mercury-containing thermostats, through either a reverse distribution system or a recycle-by-mail system. Here's how to use each system:

Reverse Distribution*

Contact your heating, ventilating, and air-conditioning (HVAC) wholesaler. Honeywell provides a special container for thermostats to each participating HVAC wholesaler. **DO NOT REMOVE THE SWITCHES FROM YOUR THERMOSTATS.** The wholesaler consolidates thermostats from heating contractors and mails them intact by United Parcel Service to Honeywell where the mercury bulbs are removed, bulked, and shipped to a mercury reclamation facility. Honeywell purchases mercury from that facility to use in new thermostats, thus closing the recycling loop for mercury.



Recycle-By-Mail*

Homeowners can call Honeywell at 1-800-345-6770*, to request a free thermostat mailer. Honeywell sends a postage-paid pre-addressed envelope mailer that is lined with a bubble pack for extra protection. A plastic zipper bag is also provided. The customer seals the thermostat in the plastic bag, puts it in the envelope mailer, and drops it in the mail.

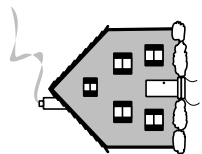
**These services may not be available in your area.*



MINNESOTA POLLUTION CONTROL AGENCY
1-800-657-3864 TDD: 612-282-5332

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
1-800-662-9278

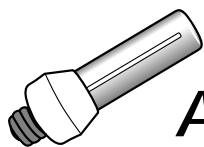
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
1-608-267-9700



Hunt For Mercury At Home — Inventory Results

Items Found	Actions Taken	Done (X)

Name: _____



Activity 5 - Trade-offs

Objective

- Evaluate the pros and cons of two alternative technologies.
- Learn how to organize data and determine the mathematical relationships needed to solve a problem.
- Coherently present the results of calculations to support a recommended choice or alternative.
- After 10,000 hours of use, what are the total costs, including purchase price and electricity, for each type of light bulb?
- Which type of bulb would you recommend? Why?
- Make an educated guess as to how many light bulbs are in use in your community. Based on this estimate, design a study to determine the differences in cost and in mercury released if all those bulbs were either incandescent or compact fluorescent.

Materials

- ✓ Handout entitled “Trade-Offs: Your Lights, Your Environment and Your Checkbook.”

Procedure

- This activity can be done as homework or as an individual or group class assignment.
- Distribute “Trade-Offs: Your Lights, Your Environment and Your Checkbook” to students and ask them to prepare answers and justifications for the following questions.
- Call upon individual students or groups to present their answers and explain the processes they used to arrive at their decisions.

Discussion Questions

- Which type of light bulb – incandescent or compact fluorescent – is more efficient? Why?
- After 10,000 hours of use, how much mercury (in grams) is released to the environment due to use of each of these two types of light bulbs?

Trade-Offs: Your Lights, Your Environment and Your Checkbook

Incandescent vs. Compact Fluorescent Bulbs— Energy Use, Mercury Emissions and Cost

The largest source of mercury to the environment is coal-burning electric power plants. There is a very small amount of mercury in the coal that is burned to produce electricity. However, because vast amounts of coal are burned, the amount of mercury released up the smoke stacks is very significant.

One of the largest uses of the electricity produced by these power plants is for lighting homes, buildings and streets. Can the choice of light bulbs in our homes make a difference in terms of the amount of electricity used, the amount of mercury released and the amount that we pay for electricity. Let's figure it out.

	<i>Incandescent Bulb</i>	<i>Compact Fluorescent Bulb</i>
Energy Requirement	60 watts.....	15 watts
Light Output	870 lumens	925 lumens
Average Life	1,000 hours	10,000 hours
Purchase Price	\$1.79 for 4 bulbs	\$13.99 each

Cost of electricity from the power plant—\$0.07 per kilowatt-hour

Pounds of mercury released per kilowatt-hour of energy used—3.69E-08 (= 0.0000000369)

Keep in Mind—

- 1 kilowatt =1,000 watts
- a lumen is a measure of brightness
- a kilowatt-hour is a measure of total energy used over a period of time
- 1 pound = 454 grams

Answers

Which type of light bulb—incandescent or compact fluorescent—is more efficient? Why?

Efficiency, in this case, is measured by light output per amount of energy used. For the compact fluorescent bulb, this is 925 lumens/15 watts = 61.67. For the incandescent bulb, this is 870 lumens/60 watts = 14.5. Thus, the fluorescent bulb is 4.25 times more efficient.

After 10,000 hours of use, how much mercury is released to the environment due to use of these two types of bulbs?

The amount of mercury released due to use of the compact fluorescent bulb is:

10,000 hours X 15 watts X .0000000369 pounds per kilowatt-hour X 454 grams per pound ÷ 1,000 watts per kilowatt = .0025 grams.

The equation for the incandescent bulb is the same, except that 60 watts is substituted for 15 watts. Thus, the amount of mercury released is 4 times greater for the incandescent bulb, or .01 grams.

After 10,000 hours of use, what are the total costs, including purchase price and electricity, for each type of light bulb?

Purchase price—

Compact fluorescent—\$13.99

Incandescent— $\$1.79/4 \times 10,000/1,000 = \4.48

Electricity cost—

Compact fluorescent

$10,000 \text{ hours} \times 15 \text{ watts} \times \$0.07 \text{ per kilowatt-hour} \div 1,000 \text{ watts per kilowatt} = \10.50

Incandescent

$10,000 \text{ hours} \times 60 \text{ watts} \times \$0.07 \text{ per kilowatt-hour} \div 1,000 \text{ watts per kilowatt} = \42.00

Total cost—

Compact fluorescent

$\$13.99 \text{ (purchase)} + \$10.50 \text{ (electricity)} = \24.49

Incandescent

$\$4.48 \text{ (purchase)} + \$42.00 \text{ (electricity)} = \46.48

Thus, the incandescent bulb is 90% more expensive.

Which type of bulb would you recommend?

Consider efficiency (compact fluorescent is 4.25 times more efficient), amount of mercury released (4 times less for compact fluorescent) and total cost (90% less for compact fluorescent).

Study design to determine the differences in cost and in mercury released for the community if all those bulbs were either incandescent or compact fluorescent.

The study design should include identification of the following steps:

- estimates of the number of bulbs used in lighting homes, streets and businesses
- assumptions about the frequency of bulb replacement
- determination of the total amount of energy
- application of the mercury released per kilowatt factor to determine total mercury releases
- determination of purchase and electricity costs



Activity 6 - Mercury In Fish

Objectives:

Students will:

- 1) know the process for determining if fish caught in certain bodies of water are listed in the Important Health Information for People Eating Fish from Wisconsin Waters;
- 2) analyze different factors that may impact which bodies of waters in Wisconsin have mercury fish advisories.

Materials:

- ✓ Important Health Information for People Eating Fish from Wisconsin Waters Booklet (1998)
- ✓ Wisconsin Road Maps or Relief Map
- ✓ Dot stickers - 4 Different Colors
- ✓ Optional: Wisconsin Lakes Booklet - (1995)

Ordering Information

To order 1 copy of both Important Health Information for People Eating Fish from Wisconsin Waters 1998 (FH 824 98Rev.) and Wisconsin Lakes (FM 800) send your request to:

Publications
DNR - CE/6
101 S. Webster St.
P.O. Box 7921
Madison, WI 53707

Background:

It is important to note that fish are good for you to eat and fun to catch. When properly prepared, fish provide a diet high in protein and low in saturated fats. Fish advisories only apply to eating your catch and in no way restrict your fishing or other water activities. The advisory will help you plan what fish to keep as well as how often and how much fish to eat. The majority of waters tested in Wisconsin do not contain contaminated fish that pose a health hazard.

Wisconsin has nearly 15,000 lakes. Over 1000 of these have been tested for fish contaminants. Since testing is very expensive the state focuses its sampling program in:

- waters where there is a known or suspected pollution source;
- lakes that may be susceptible to mercury contamination;
- popular angling waters;
- waters where long term contamination trends in fish are being tracked.

In the article, “the metal that slipped away” (p.5-11) the section *how mercury moves* provides an explanation on which bodies of water in Wisconsin are most susceptible to mercury contamination.

Students should read pages 4-13 and 32-33 of the Important Health Information for People Eating Fish from Wisconsin Waters.

Procedure:

1. Divide the class into groups of 3 students each. Assign each group 2-3 pages in the Advisory booklet from the listed bodies of water on pages 34 to 54.
2. Students should locate each body of water on the road map and place a colored dot on that location. The color of the dot should correspond to the highest Group listed for that body of water. Put the initial of the type of fish on the dot, for example W for walleye (Fig 1). When all groups have completed this, have the students stick the dot to the classroom road map. Each dot should just be placed at the correct location until all bodies of water are found. Some bodies of water may not be found.
3. Discuss the questions on the student sheet.

Extension:

- 1) Use a county map to locate all of your bodies of water in your county. Find the locations of coal-burning power plants. How Does Mercury Get Into Fish?
- 2) If available, use the Wisconsin Lakes Book to investigate other characteristics of these bodies of water.

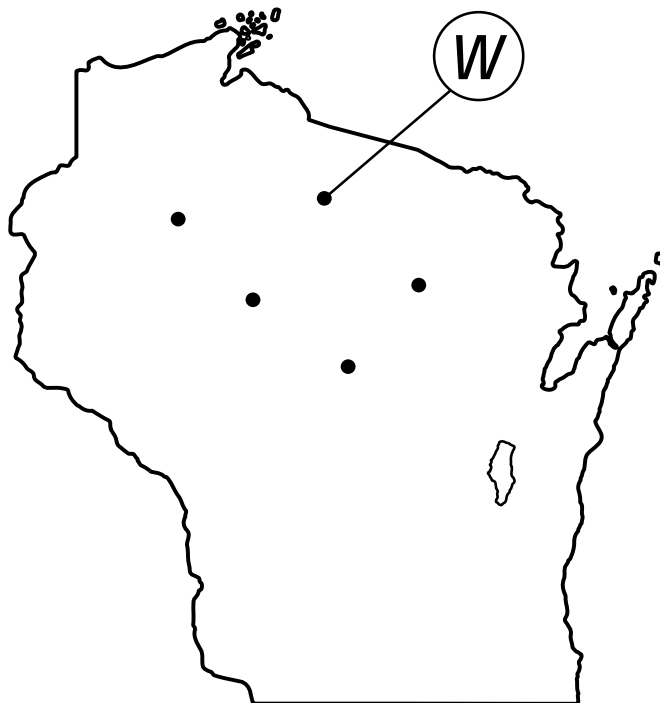


Figure 1

How Does Mercury Get into Fish?

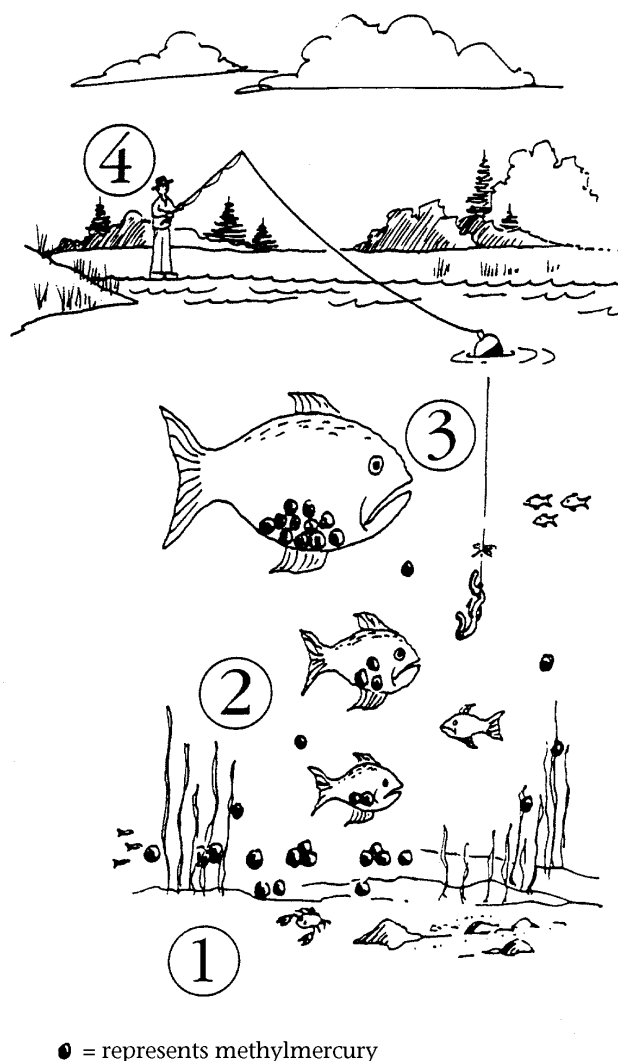
Once in a lake or river, mercury is converted to methylmercury by bacteria and other processes. Fish absorb methylmercury from their food and from water as it passes over their gills. Mercury is tightly bound to proteins in all fish tissue, including muscle. **There is no method of cooking or cleaning fish that will reduce the amount of mercury in a meal.**

Methylmercury accumulates as you move up the food chain:

1. Methylmercury in the water and sediment is taken up by tiny animals and plants known as plankton.
2. Minnows and juvenile fish eat large quantities of plankton over time.
3. Large predatory fish consume many smaller fish, accumulating methylmercury in their tissues. The older and larger the fish, the greater the potential for high mercury levels in their bodies.
4. Fish are caught and eaten by humans and animals, causing methylmercury to accumulate in their tissues.

In Wisconsin and Michigan lakes, the highest methylmercury levels are found in large walleyes. High mercury levels may also be found in trout, large mouth bass and northern pike. Panfish, such as perch and bluegill, contain the lowest levels.

The Health Departments in Minnesota, Wisconsin and Michigan publish an annual *Fish Consumption Advisory*. The advisory provides guidelines on how often fish from certain lakes and rivers can be safely eaten. For more information, or to obtain a copy of the *Fish Advisory*, call 1-800-657-3908 in Minnesota; 608-267-7610 in Wisconsin; and 517-335-8350 in Michigan.



HOW TO USE THIS MERCURY ADVISORY

An important note regarding fish on the mercury portion of this advisory. *Mercury is distributed throughout a fish's muscle tissue (the part you eat) rather than in the fat and skin. The only way to reduce mercury intake is to reduce the amount of contaminated fish you eat.*

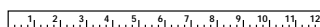
Meal advice for mercury is presented slightly differently than for PCBs. The advice is based on the following groups:

Group 1	Group 2	Group 3	Group 4
<p>Pregnant women should eat no more than one meal a month of Group 1 fish.</p> <p>Everyone else may eat unlimited amounts of Group 1 fish. Fillets average 0.5 ppm mercury or less.</p>	<p>Pregnant or breastfeeding women, women who plan to have children, and children under 15 should not eat Group 2 fish.</p> <p>Everyone else should eat no more than 26 meals of Group 2 fish a year. Eat no more than 13 of these in any one month. Space the remaining 13 meals over the rest of the year at rate of one or two meals a month. Fillets average 0.5 to 0.75 ppm mercury.</p>	<p>Pregnant or breastfeeding women, women who plan to have children, and children under 15 should not eat Group 3 fish.</p> <p>Everyone else should eat no more than 13 meals of Group 3 fish a year. Eat no more than 7 of these meals in any one month, and space the remaining 6 meals over the rest of the year at a rate of one meal a month. Fillets average 0.75 to 1.0 ppm mercury.</p>	<p>No one should eat Group 4 fish.</p> <p>Skin-on fillets average above 1.0 ppm mercury.</p>

Example: You are on a family vacation, fishing on Lots-o-Fish Lake in Chippewa County. You catch a 25-inch northern.

First

Measure your fish from the tip of the nose to the end of the tail and determine what type of fish it is.



Then

Go to the table and find Chippewa County; then find Lots-o-Fish Lake.

Then

The advisory group for your fish is under the size category for the fish you've caught.

A 25-inch northern from Lots-o-Fish Lake in Chippewa County is a Group 2 fish. If you decide to keep the fish for eating, follow the advice for a Group 2 fish at the top of the mercury tables on page 32.

County/Water	Fish Species	Length (in inches)							
		<10	10–12	12–15	15–18	18–22	22–26	26–30	>30
Chippewa County	Tip! Find the county and the water where you caught your fish here.								
Lots-o-Fish Lake	Northern Pike	•	•	•	1	1	2	2	•
Tip! Find the type of fish you've caught here.		Tip! Find the meal advice for the fish you've caught here. The number refers to the groups at the top of this table.							

- This symbol means not enough information on a particular size and species of fish was available to issue health advice.

Student Sheet

1. Do you see any patterns in the locations of the bodies of water that have mercury warnings?

What are the possible reasons?

2. Do you see any patterns in regards to the types of fish?

What are the possible reasons?

3. What size fish seem to have a higher grouping?

What are the possible reasons?

4. Find the rivers and flowages. Do these areas have any common characteristics?

What are the possible reasons?

5. Look at those bodies of waters with Group 4 fish. Do you see any possible patterns?

What are the possible reasons?

6. How can the information in this advisory be shared in your community to insure that all anglers are aware of the warnings listed in the book?

If available, use the Wisconsin Lakes Book to investigate other characteristics of these bodies of water.



Activity 7 - Mercury Community Action Projects

Objective:

Students will develop and implement an action plan to reduce the concerns and impacts of mercury in their community.

Materials:

Background materials in this set of activities.

Background:

Your students will be investigating the “real world”. Completing a “Community Action Project” is based on the following assumptions:

- Society must solve community environmental issues with participation from its young members.
- Students need to know they can be forces for constructive change.
- Students need the opportunity to investigate and act upon a problem of their choice to increase their motivation to learn.
- The school and its community need to be connected to show relevance to the real world. The classroom is part of the community and the community is part of the classroom.

The Community Action Project will provide the students an opportunity to apply the knowledge they have acquired about mercury to improve how mercury is handled in the community. The students will use skills in research, investigation, problem-solving and working in groups.

The following are some possible action plans:

- Community outreach program about mercury; for example display and handout(s) about mercury and take it to various public venues;
- Discuss mercury spill prevention and clean up with school janitorial staff, local fire department and/or Hazmat (hazardous materials) Team;

- Promote a mercury or household hazardous waste collection program in your community;
- Prepare labels for equipment that contains mercury and work with school janitorial staff, nursing homes and/or others to place these on mercury thermostats and other equipment;
- Check store inventories and work with store owners to ensure that no mercury-containing games (e.g. maze games) are being sold to small children;
- “Adopt” a hospital, or nursing home and work with them to minimize their use of mercury and safely recycle their existing mercury.
- Work with your electric utility to promote a mercury thermostat recycling program;
- Perform mercury audits for grade schools and middle schools in your school district;
- Other ideas from the students

Procedure

Students can undertake this activity as a class or in groups. They will brainstorm a list of recommendations for their community on mercury reduction. Based on this list, they will choose one activity and develop an action plan that will include the following:

- Identify the problem to be addressed
- List methods to address the problem
- Select the best action
- Determine the resources needed to complete the action plan
- Identify possible partners for the program
- Develop a time line
- Implement the project
- Evaluate the project for making any changes

The class or groups will then implement their action plan.

Mercury On The Internet

Characteristics of Mercury -

www.crl.com/~peters/periodic/80.htm

State of Minnesota Mercury Website

www.pca.state.mn.us/air/mercury.html

U.S. Environmental Protection Agency (EPA) Report to Congress on Mercury

www.epa.gov/oar/mercover.html

U.S. EPA Mercury Website

www.epa.gov/glnpo/p2/mercpam.html#Table

State of Michigan Mercury Pollution Prevention Website

www.deq.state.mi.us/ead/p2sect/mercury/

Milwaukee Mercury Source Assessment

www.epa.gov/glnpo/bns/milwaukeehg/summary.html

"Mercury Pollution Prevention in Healthcare: A Prescription for Success"

www.igc.org/nwf/greatlakes/pp/hosprpt.html#Mercury

"Disposal Guide to Household Hazardous Waste"

www.epa.gov/glnpo/p2/Lkwatchc.html